

Electronics Response to Cable Cost Issues

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Critical Cost Drivers:

- Pairing of signals
- Sense Capability
- Voltage Drops
- Location of Supplies

Features of Present Cable Design

All power supply, control, and sense lines have separate supply and return, and there are some extra conductors:

- Could reduce this significantly by keeping a minimal number of return connections. Can also replace ISET1 and ISET2 by single ISET. Would be reluctant to drop RESET yet, because it is the only spare conductor in the cables.
- Minimum would seem to involve a DigitalPowerReturn, a DigitalSignalReturn, and an AnalogPowerReturn. The two separate digital returns are needed because of the large voltage drop on the supply return (1V in present cable, and could grow). This would also place temperature return on a noisy ground, so proper averaging in temperature conversion would be required.

Voltage drops on present cable plant limited to 2V:

- This is only 1V for supply and 1V for return. It was motivated primarily by concerns about the ability of the module electronics to survive large voltage transients which seem inevitable in our long cables.
- This appears less critical after recent visit to DMILL. In addition, we are evaluating transient protection which could be either mounted on the module or at PP1.
- Elimination of large conductors (#10 and #12 AWG wire) in long Type 3 and 4 cables has a large effect on cost. This **MUST** be studied in prototypes.

Sense cables:

- Present concept for sensing and correcting for drops on power cables involves sensing the current provided, and including the cable resistance to estimate the correct voltage at the supply. This has not yet been evaluated.
- In the absence of experience with current sensing, would be very reluctant to give up sense wires. Voltage sense should not require a pair for each voltage. Again, this is something to study in prototypes. At least the remote sense wires allow monitoring, even in situ...

Location of Supplies:

- Overall length of cables is a critical driver of cost, particularly within a constant ΔV budget (cost goes as square).
- Significant reduction in “worst case run”, and “average run” can be obtained by placing large fraction (about 50% ?) of supplies in US15 on the other side of the cavern. This eliminates the need to route cables over the top of the detector.
- The cost and length reductions for this case should be examined. There is a tradeoff, in that US15 is not accessible during machine operation. It is likely to be accessible once per day for a limited period of time. In addition, the infrastructure in this area will be quite primitive compared to USA15.

Cable Prototype evaluation with good quality modules is vital before freezing design...